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EFFECT OF SANDPAPER (*Ficus exasperata*) LEAF MEAL ON GUT MORPHOLOGY AND NUTRIENT DIGESTIBILITY OF FINISHER BROILERS

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Abstract
The trial evaluates effect of sandpaper leaf meal on gut morphology and nutrient digestibility of finisher broiler chicks. *Ficus exasperata* leaf meal was included in the diets of the birds at 0% (control), 1%, 2% and 3% of 100kg feed in treatment 1, 2, 3 and 4 respectively. A total of ninety-six (96) day old broiler chicks was used for this trial. The birds were randomly divided into four (4) treatments of three (3) replicates and each replicate contained eight (8) birds. Results; all parameters evaluated were significantly ($P<0.05$) influenced by the inclusion levels of sandpaper leaf. Improved crude protein digestibility recorded in this study would have resulted from improved accessibility to the entrap proteins in the diet which could have been aided by gut microflora. Highest ($P<0.05$) villus height value of 368.57µm was recorded from 3% (T4) while least value of 353.43µm was recorded from 0% (T1). Villi muscle thickness decreased with increase in sandpaper leaf meal levels. Reduced crypt depth recorded from birds that received antibiotics inclusion is indicative of lower secretory activity such as lower mucus production. Reduction in ileum muscle thickness with increase in dosage level indicated that absorption of nutrients may be impeded by an increase in the thickness of the unstirred layer in the small intestine. Thus, reduced muscle thickness observed from the birds that received inclusion levels of sandpaper leaf meal allows for better nutrient permeability into the blood stream.
Key words: Sandpaper, Morphology, Digestibility, Nutrient, Broiler.

INTRODUCTION
Due to restrictions in several countries on the use of antibiotic growth promoters in meat production (poultry, beef and pork), replacing these compounds is of great interest (Surai, 2014). Thus, various alternatives, including dietary supplementation with secondary plant metabolites, referred to as phytochemical feed additives, phytogenic feed additives, phytobiotics, or herbal and botanical compounds (Ganguly, 2013), have been proposed. The use of phytochemicals in animal feed is accepted by consumers as herbal medicines have been consumed by humans for centuries (Surai, 2014). Many plants have beneficial multifunctional aspects which are derived from their specific bio-active components. Several herbal sources have been used effectively in poultry production for better gains and healthy poultry production (Reddy *et al*., 2012). Beneficial effects of bioactive plant substances in animal nutrition may include the stimulation of appetite and feed intake, the improvement of endogenous digestive enzyme secretion, activation of immune responses and antibacterial, antiviral and antioxidant action (Hosseini-Vashan *et al*., 2012).

Materials and Methods
The experiment was carried out at the Poultry Unit of the Teaching and Research Farm, Federal College of Agriculture Ishiagu, Ebonyi state. The plant was selected for this study based on its ethno-medicinal use. Fresh leave of Sandpaper (*Ficus exasperata*) leaf was harvested (without stock) from middle aged green trees. The leaf was washed in running water and then air dried (to prevent bleaching) for 14 days until crispy but still retaining the greenish tint. The turning of leaf was carried out on regular intervals (daily) to prevent uneven drying and possible decay of leaves. The leaf was hammer milled and converted into ground form which was stored in an air tight container prior to usage. Four (4) experimental diets were formulated based on the nutritional requirements of the birds and such that additive values of *Ficus*

exasperata leaf in the diets of the birds were 0% (control), 1%, 2% and 3% in treatment 1, 2, 3 and 4 respectively. The composition of the diets was as presented below.

Table 1: Composition of Experimental Broiler Finisher Diets

Ingredients	**T1 (0%)**	**T2 (1%)**	**T3 (2%)**	**T4 (3%)**
Maize	56.00	56.00	56.00	55.00
Wheat offal	4.50	3.50	3.50	3.50
Soybean	18.00	18.00	18.00	18.00
Groundnut cake	16.00	16.00	15.00	15.00
Fish	1.50	1.50	1.50	1.50
Bone	2.00	2.00	2.00	2.00
Limestone	1.00	1.00	1.00	1.00
Salt	0.25	0.25	0.25	0.25
Premix	0.25	0.25	0.25	0.25
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
SLM	-	1.00	2.00	3.00
Total	**100.00**	**100.00**	**100.00**	**100.00**
Calculated values				
ME (kcal/kg)	3030.49	3029.49	3028.48	3027.48
Crude protein (%)	20.42	20.34	20.27	20.20
Ether extract (%)	6.67	6.67	6.67	6.67
Crude fibre (%)	3.30	3.46	3.69	3.85
Lysine (%)	1.24	1.24	1.24	1.24
Methionine (%)	0.57	0.57	0.57	0.57
Calcium (%)	1.12	1.12	1.12	1.12
Phosphorus (%)	0.59	0.59	0.59	0.59

ME = Metabolisable Energy

A total of ninety-six (96) day (post-hatch) old broiler chicks (Cobb-500 strain) from a reputable commercial farm was used for this trial. The birds were randomly divided into four (4) treatments of three (3) replicates and each replicate contained eight (8) birds, which made it a total of twenty-four (24) birds per treatment. Vaccinations and Medication (Antibiotics and Extract) were done concurrently as at when due (at first, third and fifth week respectively). Feed and water were given *ad-libitum.* The trial lasted for 8 weeks. On the final day of the experiment (56^{th} day), two (2) birds per replicate were randomly selected, weighed and put in metabolic cages. Birds were fed experimental diets, and allowed to acclimatize for four (4) days after which faecal samples were collected daily for three days. The fresh as well as sun dried weight of the faecal samples were recorded. After sun drying, the samples were stored properly before analysing for proximate composition using the procedure of AOAC (2015). To measure height and width of villi ileum, tissue samples of that portion were taken from three randomly selected birds per treatment at 56 days of age. The segment of the ileum was taken (from Meckel's diverticulum to ileo - caeco - colic junction). The tissue samples of approximately 1 cm^2 in size each were cut and dropped in 10% formaldehyde solution. Histological analysis was done according to the procedures of Goodlad *et al.* (1991). The experiment was laid down in a Completely Randomized Design (CRD). Data collected were analysed by One Way Analysis of Variance using SPSS (23) software and means were compared using Duncan's Multiple Range Test of the same package and considered significant when $P<0.05$.

Results and Discussion

From Table 2 below, all parameters evaluated were significantly (P<0.05) influenced by the inclusion levels of sandpaper leaf. Values recorded from crude protein, crude fibre, ash and nitrogen free extract all increased with increase in levels of sandpaper leaf meal. Highest (P<0.05) crude protein digestibility value of 74.77% was recorded from the group that received highest inclusion of sandpaper leaf meal while least value of 63.19% was recorded from the control group (T1) that received antibiotics. Optimum (P<0.05) crude fibre digestibility of 65.26% was recorded from 3% (T4) while least value of 53.95% was recorded from control group (0%). Ether extract digestibility value decline with increase in sandpaper meal levels 70.01% - 64.74%. Improved crude protein digestibility recorded in this study would have resulted from improved accessibility to the entrap proteins in the diet which could have been aided by gut microflora. Mitaru *et al.* (1983) reported that the extent of the decrease in crude protein digestibility also depends on the degree at lignification of the fibre. Decrease ether extract digestibility recorded might have been influenced by the hypoglycemic nature of sandpaper leaf. The progressive increase in crude fibre digestibility of the birds that received higher inclusion levels cannot be explained.

Table 2: Effect of Sandpaper (*F. exasperata*) Leaf Meal on Nutrient Digestibility of Finisher Broiler

Parameters	T1 (0%)	T2 (1%)	T3 (2%)	T4 (3%)	SEM
Dry matter	88.11^{b}	88.29^{b}	88.15^{b}	88.94^{a}	**0.08**
Crude protein	63.19^{d}	67.13^{c}	73.04^{b}	74.77^{a}	**0.82**
Crude fibre	53.95^{d}	59.11^{c}	62.72^{b}	65.26^{a}	**0.74**
Ash	44.04^{d}	46.30^{c}	50.79^{b}	55.58^{a}	**0.76**
Ether extract	70.01^{a}	68.47^{b}	66.58^{c}	64.74^{d}	**0.35**
Nitrogen Free Extract	40.34^{d}	44.84^{c}	49.48^{b}	55.85^{a}	**0.98**

^{abcd} Means with similar superscripts along the same row are not significantly (P > 0.05) different

Significant differences were recorded across all parameters evaluated (Table 3). Highest (P<0.05) villus height value of 368.57µm was recorded from 3% (T4) while least value of 353.43µm was recorded from 0% (T1). Villus width increased with increase in inclusion levels of sandpaper leaf meal, highest (P<0.05) value of 35.29 µm was recorded from 3% (T4) while least value of 29.54 µm was recorded from control group that received antibiotics. Crypt depth values increased progressively and ranges from 149.95 µm – 159.18 µm. Villi muscle thickness decreased with increase in sandpaper leaf meal levels and the values ranges from 98.44 µm – 87.02 µm. The density and size of villi and microvilli of small intestine are directly related and or has positive correlation to the absorption capacity of the birds. It is assumed that an increased villus height is correlated by an increased digestive and absorptive function of the intestine due to increased absorptive surface area, expression of brush border enzymes and nutrient transport systems (Noy *et al.*, 2001). Previous, work by Hedemann *et al.* (2003) confirmed that crypt depth and villi length are related to the rate of sensory activity and increase/decrease in cell turn over. Reduced crypt depth recorded from birds that received antibiotics inclusion is indicative of lower secretory activity such as lower mucus production (Langhout *et al.*, 1999). Engberg *et al.* (2004) reported that reduced intestinal crypt depth could be linked with reduced intestinal microbial population and subsequently reduction in nutrient absorption. Reductions in ileum muscle thickness with increase in dosage level corroborate with the report of Silva and Smithard (2002) that the absorption of nutrients may be impeded by an increase in the thickness of the unstirred layer in the small intestine. Thus, reduced muscle thickness observed from the birds that received inclusion levels of sandpaper leaf meal allows for better nutrient permeability into the blood stream.

Table 3: Effect of Sandpaper (*F. exasperata*) Leaf Meal on Gut Morphology of Finisher Broiler

Parameters	T1 (0%)	T2 (1%)	T3 (2%)	T4 (3%)	SEM
Villus Height (µm)	353.43^{d}	361.54^{c}	366.33^{b}	368.57^{a}	**1.01**

Villus Width (µm)	29.54[d]	31.65[c]	33.15[b]	35.29[d]	**0.35**
Crypt Depth (µm)	149.95[d]	152.59[c]	155.54[b]	159.18[a]	**0.58**
Muscle Thickness (µm)	98.44[a]	95.76[b]	91.23[c]	87.02[d]	**0.74**

[abcd] Means with similar superscripts along the same row are not significantly (P > 0.05) different

Conclusion and Recommendation

Nutrient digestibility increased with increase in inclusion levels of sandpaper leaf meal in the diet which would have been influenced by improvement in absorptive surface; increased villus height and decrease muscle thickness among others. Higher inclusion levels of sandpaper leaf meal are recommended to ascertain the optimum inclusion levels.

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